

THREE-CHANNEL CAPACITIVE BUTTON TOUCH SENSOR IC AI03B DATASHEET

OVERVIEW

The AI03B is a 3-channel capacitive button sensor IC, with one to one output mode . The IC uses MSOP10 package.

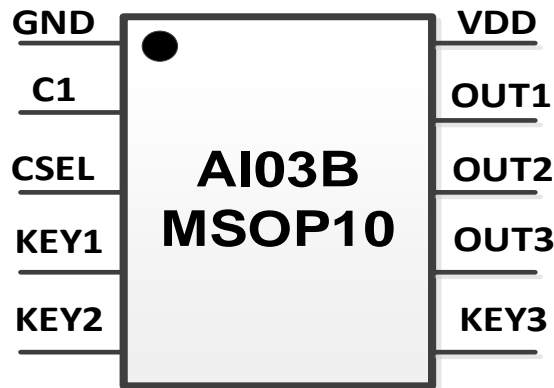
APPLICATIONS

- ◆ Consumer Electronics
- ◆ Home Appliances
- ◆ Mechanical Button Replacement.

FEATURES

- ◆ High sensitivity, capable of sensing through overlay glass up to 13mm thickness(electrode size dependent)
- ◆ 8kV ESD Rating on All Pins(HBM)
- ◆ Simplify PCB design, only one 4.7nf capacitor needed
- ◆ Power Saving, Supports Sleep mode
- ◆ Operating Voltage: 2.5V ~ 5.5V
- ◆ Operating Temperature: -40°C ~ +85°C
- ◆ Package: MSOP10

PIN DIAGRAM



The AI03B Pin Diagram

PIN DESCRIPTIONS

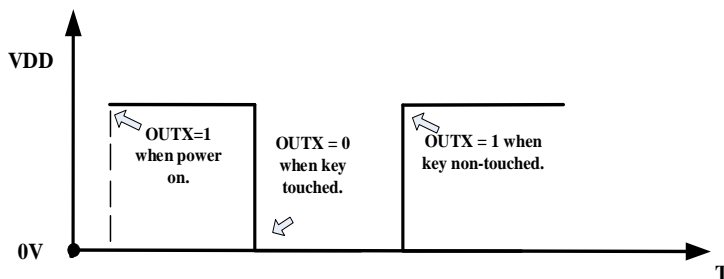
Pin#	Funtion	Type	Description
1	GND	G	GND Ground
2	C1	I	Internal Cap interface
3	CSEL	I	Sensitive adjust cap interface
4	KEY1	I	Touch button 1
5	KEY2	I	Touch button 2
6	KEY3	I	Touch button 3
7	OUT3	OD	Output for KEY3 out. default pull high, active low.
8	OUT2	OD	Output for KEY2 out. default pull high, active low.
9	OUT1	OD	Output for KEY1 out. default pull high, active low.
10	VDD	P	VDD Power

Note:

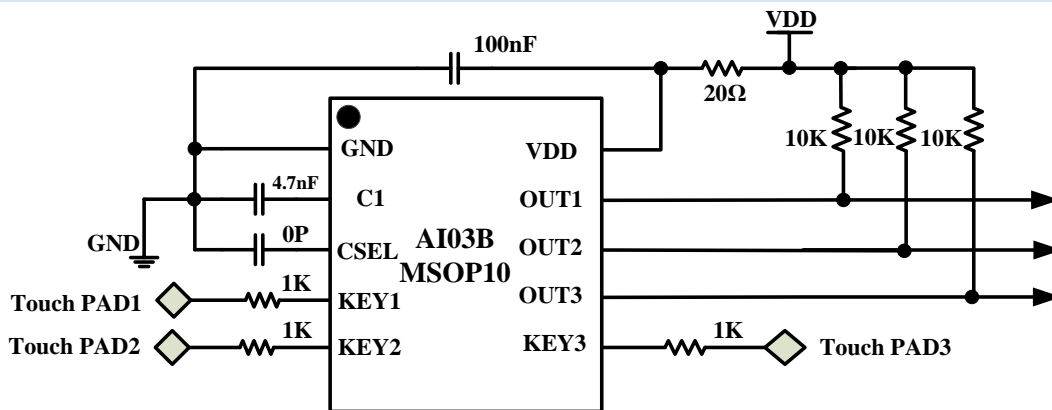
1. I = Input; OD = Open drain output, B = Bidirectional; P = Supply; G = Ground

OUTPUT MODE:

The following figure shows the state of the OUTX pin when IC power up and KEY is pressed and released respectively.



APPLICATION CIRCUIT



Note:

- ◆ C1 is internal balance Cap , range 1nf~10nf , default 4.7nf.
- ◆ CSEL is sensitive adjust setup capacitor. The more capacitor value , the less sensitive. The max value of CSEL Cap is 100pF . The capacitor value is decided by application environment and keypad size. In most cases the CSEL could be skipped.

RATED OPERATING CONDITIONS

Parameter	Range	Units
VDD	-0.3~6.0	V
IO Voltage	-0.3~6.0	V
Operating temperature	-40~85	°C
Store temperature	-55~150	°C
ESD(HBM)	≥8000	V

ELECTRICAL SPECIFICATIONS

Symbol	Description	Condtion	Minimum	Typical	Maximum	Units
VDD	Operation voltage		2.5		5.5	V
I_sleep	Sleep current			45		uA
I_vdd	Working current	VDD=3.0V		0.8		mA
		VDD=5.0V		1.6		mA
T_init	Initialization time when power up.			400		mS
CSEL	CSEL capacitor for sensitivity adjustment.		0		100	pF

FUNCTION DESCRIPTION

1. Initialization

The AI03B needs about 400mS to calculate the environmental parameters after power on, and automatically calibrate the parasitic capacitance.

2. Automatic Calibration Function

The AI03B automatically recalibrate and compensate for gradual environmental changes. When any touch button is pressed and held for 30~60seconds, the chip will consider the sensing capacitance as environmental factor and automatically recalibrate and compensate it.

3. Sleep Mode

In order to reduce the standby power consumption of the chip, the AI03B will fall into the sleep mode if no operation for longer than 80 seconds. The Button sampling interval time is longer, the VDD current is decreased, the chip power consumption is reduced. The chip will exit the sleep mode, if any button operation is detected.

APPLICATION NOTES

The AI03B's peripheral circuit is very simple, only a small number of capacitors and resistors are used. Figure 1 is the typical application circuit of AI03B.

1. Internal balance capacitance and sensitivity

Adjustment capacitor C1 capacitor and CSEL capacitor is recommended to use a precision of 10% of the NPO material, in the PCB layout, place C1 capacitor and CESL capacitor as close to the IC placement.

2. Sensitivity capacitance and key press PAD to detect

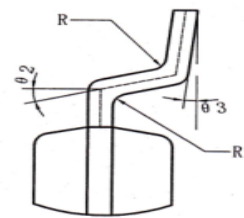
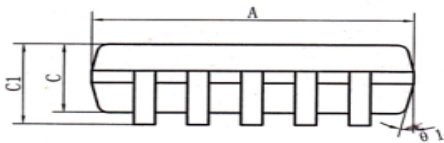
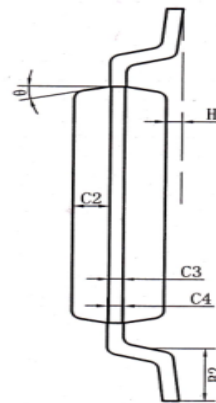
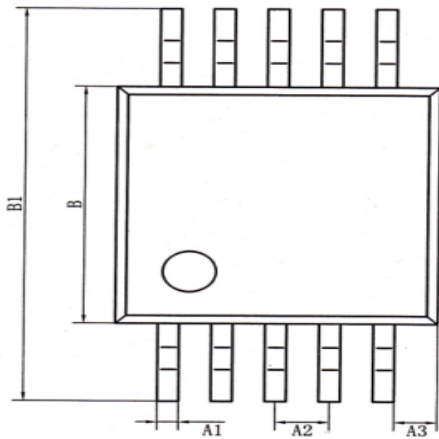
The electrode materials can be glass, acrylic, plastic, ceramics and so on. The CSEL capacitor value is decided by the area of the electrode、 the thickness of the panel、 the panel material and the layout of the PCB board. The thicker the isolation material, the smaller the CSEL capacitor is required to be used (which will increase the sensitivity of the detection). Meanwhile, increasing the the area of PAD appropriately also increase the sensitivity. On the contrary, the thinner the isolation material, and increasing the CSEL capacity appropriately will increase the system's ability to resist interference. The general recommendation capacitance value is 0~100pF.

In general, the area of touch pad plate is between 3mm*3mm and 30mm*30mm .Each plate should be the same area as possible as it can be to ensure the same sensitivity. The sensing plate can be a conductor of any shape and is recommended to circular or square. The circular diameter or the square width is recommended to be larger than 10mm . The general sensing plate materials include copper foil on PCB board, flat top cylinder, spring, metal sheet and conductive rubber, etc.

3. VDD power supply voltage note

The AI03B measures the tiny change of capacitance, which requires the ripple and noise of power supply to be small, and the external power supply interference should be avoid. Especially when applied to high noise environment, it must be able to effectively isolate external interference and voltage mutation . The layout of Power supply in PCB should be keep away from the high-voltage high-current device area as far as possible, or add shielding. If the power ripple is too large, it is recommended to do special treatment to the power supply, such as adding filtering circuit or regulating circuit such as 78L05. In certain applications, keep the AI03B as far away from certain functional circuits as possible, such as radios, RF, etc.

PACKAGE SIZE INFORMATION (MSOP10)



Symbol	Dimensions In Millimeters		
	MIN	TYP	MAX
A	2.90	3.0	3.10
A1	0.18	----	0.25
A2	0.50 TYP		
A3	0.40 TYP		
B	2.90	---	3.10
B1	4.70	4.90	5.10
B2	0.45	----	0.75
C	0.75	---	0.95
C1	----	----	1.10
C2	0.328 TYP		
C3	0.152		
C4	0.15	----	0.23
H	0.00	----	0.09
θ	15° TYP		
$\theta 1$	12° TYP		
$\theta 2$	14° TYP		
$\theta 3$	0° ~ 6°		
R	0.15 TYP		
R1	0.15 TYP		